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ASD-TDR-62-426

(Unclassified Title)

Subsonic Low Altitude Bomber

Gordon A. Taylor

TECHNICAL DOCUMENTARY REPORT NO. ASD-TDR-62-426
June 1962

Directorate of Advanced Systems Planning
Aeronautical Systems Division
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio

Project No. 7990

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FOREWORD

This report was prepared by Mr. Gordon A. Taylor of the Design Integration Section, Aerospace Vehicle Design Branch, Systems Analysis Division, Directorate of Advanced Systems Planning, Deputy Commander/Technology, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. The work was conducted in response to a mission requirement established by the Systems Effectiveness Division as a result of their analyses for Technological Force Structure Plan (TFSP), Task 9. (U).

This document is classified SECRET because it includes estimated performance figures for a potential weapons system.

ABSTRACT

A Subsonic Low Altitude Bomber with a sea level range of 4,380 nautical miles and an altitude range of 11,000 nautical miles has been designed. Although laminar flow control was considered, it was found to be undesirable for this mission. (S)

This technical documentary report has been reviewed and is approved.

J. R. HOOD, Jr. Col. USAF
Chief, Directorate of Advanced
Systems Planning
Deputy Commander/Technology

LIST OF ILLUSTRATIONS

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In Technological Force Structure Plan (TFSP) Task 9, interest was generated in strategic aircraft which could attain extremely long strike ranges with penetrations performed at very low altitude. The probability of penetration into enemy territory can be increased significantly by low altitude flight. Consequently, a Subsonic Low Altitude Bomber has been designed to satisfy a requirement for 12,500 nautical miles of range at altitude with 12,500 pounds of payload. A sea level dash range of 2,500 nautical miles was also required with a trade-off of not more than 2.5 miles of range at altitude for each mile of sea level range. The specified minimum speed was Mach number 0.6. (S)

A preliminary parametric study indicated that a turbulent aircraft design could not meet the requirements for range at altitude within the present state-of-the-art. A higher lift to drag ratio or a fan engine with a lower specific fuel consumption would be required. In the absence of more favorable engine data, it was decided to investigate the improved lift to drag ratio obtainable through the use of laminar flow control (L.F.C.). Aircraft having laminar flow over both wing and tail surfaces for reduced drag were examined and found to exceed the required range at altitude. During cruise at sea level, however, the L.F.C. designs lost their advantage. Laminar flow could no longer be achieved due to the high Reynolds number. In addition, the optimum L.F.C. wing was larger than a comparable turbulent wing, thereby producing higher drag during low altitude cruise. As a result, the ratio of total range to sea level range for aircraft with laminar flow control was considerably above the acceptable value regardless of the gross weight. Since we did not see a solution to this problem it was decided to abandon the laminar flow control designs at this time. (U)

Interest in turbulent aircraft was renewed with the realization that inflight refueling would be required if better specific fuel consumptions could not be achieved. A point design was done with a wing loading of 150 PSF, which would yield good sea level range without over compromising the range at altitude. As the design progressed however, it was found that the take-off distance was excessive, so the parametric study was expanded to include this quantity. The range at altitude was not greatly affected by wing loading but was considerably altered by changes in aspect ratio. An aspect ratio of 8.0 appeared to be most desirable. To achieve good low altitude cruise performance but maintain reasonable take-off distance, a wing loading of 125 PSF was chosen. From the Breguet equation, the best-range at the altitude for optimum lift coefficient was achieved at the highest speed compatible with the drag rise of the design. In this case, Mach number 0.8 was used to simplify the parametric study, although the actual drag divergent Mach number was somewhat higher. At low altitude, however, the best range is obtained at the lowest permissible speed of Mach number 0.6, since at constant altitudes the thrust required increases directly with speed. (S)

The resulting preliminary design has satisfactory take-off distance and exceeds the sea level range requirement, although inflight refueling is necessary to meet the high altitude range requirement. (U)

The design and performance data are given in figures 1 through 6. A brief summary of the aircraft is presented in tables 1 and 2.

Manuscript released by the author 16 April 1962 for publication as an ASD Technical Documentary Report.

Table 1

DESIGN CHARACTERISTICS

Gross Weight	500,000 lb
Payload	12,500 lb
Weapons Bay Volume (in 2 Bays)	4,200 ft^3
Weapon Weight	9,000 lb
Load Factor	2.5
Range at Altitude (Mach No. 0.8)	11,000 NM
Range at Sea Level (Mach No. 0.6)	4,380 NM
Range Ratio	2.51
Take-off Distance (over 50 ft. obstacle)	8,639 ft
Wing Area	4,000 sq ft
Wing Span	179.0 ft
Aspect Ratio	8.0
Wing Sweep at 25% chord	30 degrees
Wing Loading	125 lb/sq ft
Fuselage Length	160 ft
Fuselage Diameter	13 ft
Number & type of Engine	(4) MF 239C-3
Sea Level Static Thrust (per engine)	26,800 lb

Table 2

WEIGHT ESTIMATE

Structure			118,146 lb
Propulsion			28,220 lb
Equipment			8,470 lb
Weight Empty			154,836 lb
Crew			900 lb
Payload	ADO 22	3,500 lb	
	Missiles	9,000 lb	12,500 lb
Fuel			331,764 lb
Gross Weight			500,000 lb

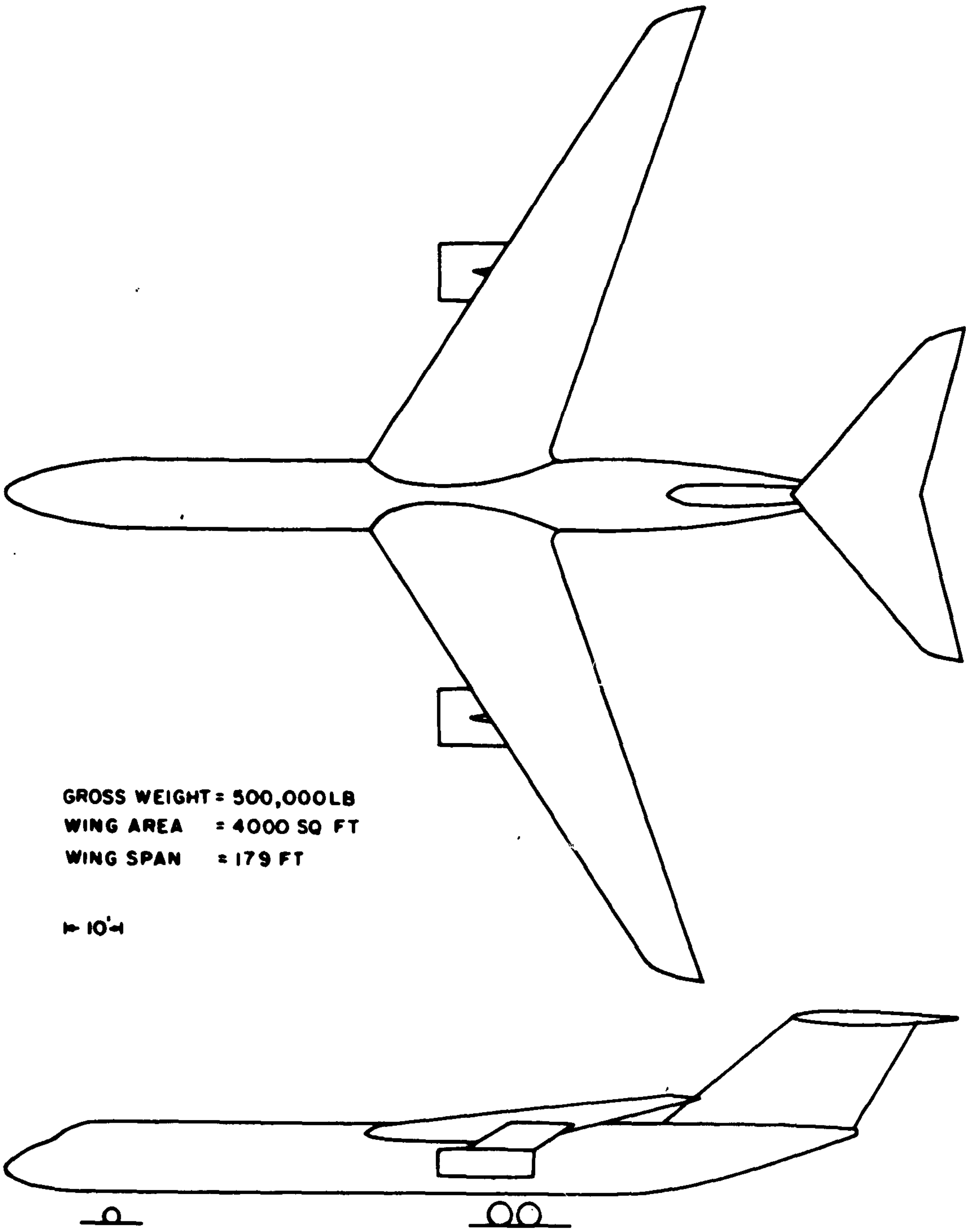

Figure 1. Subsonic Low Altitude Bomber

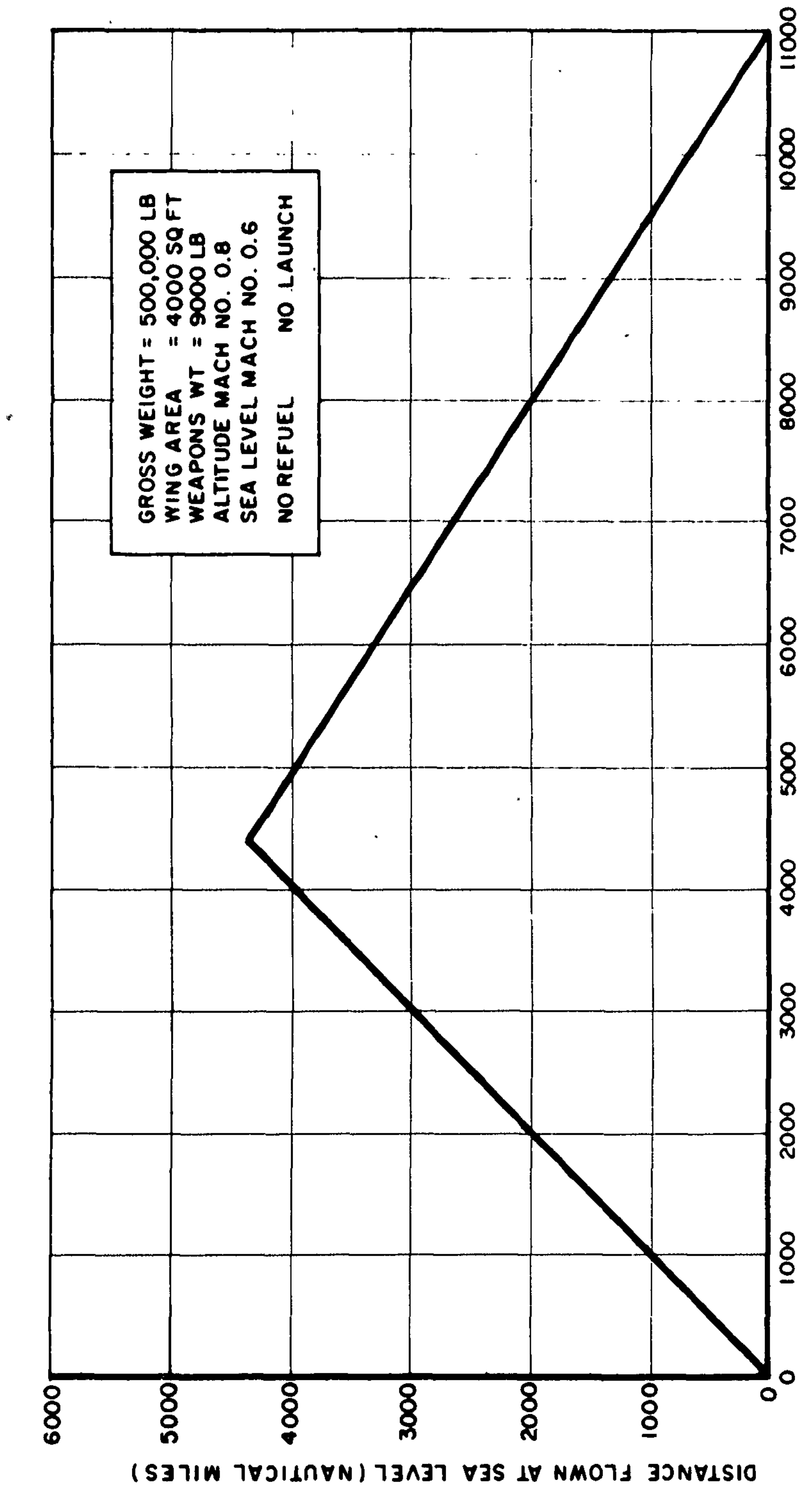

Figure 2. Subsonic Low Altitude Bomber: Trade-Off; Sea Level vs Total Range

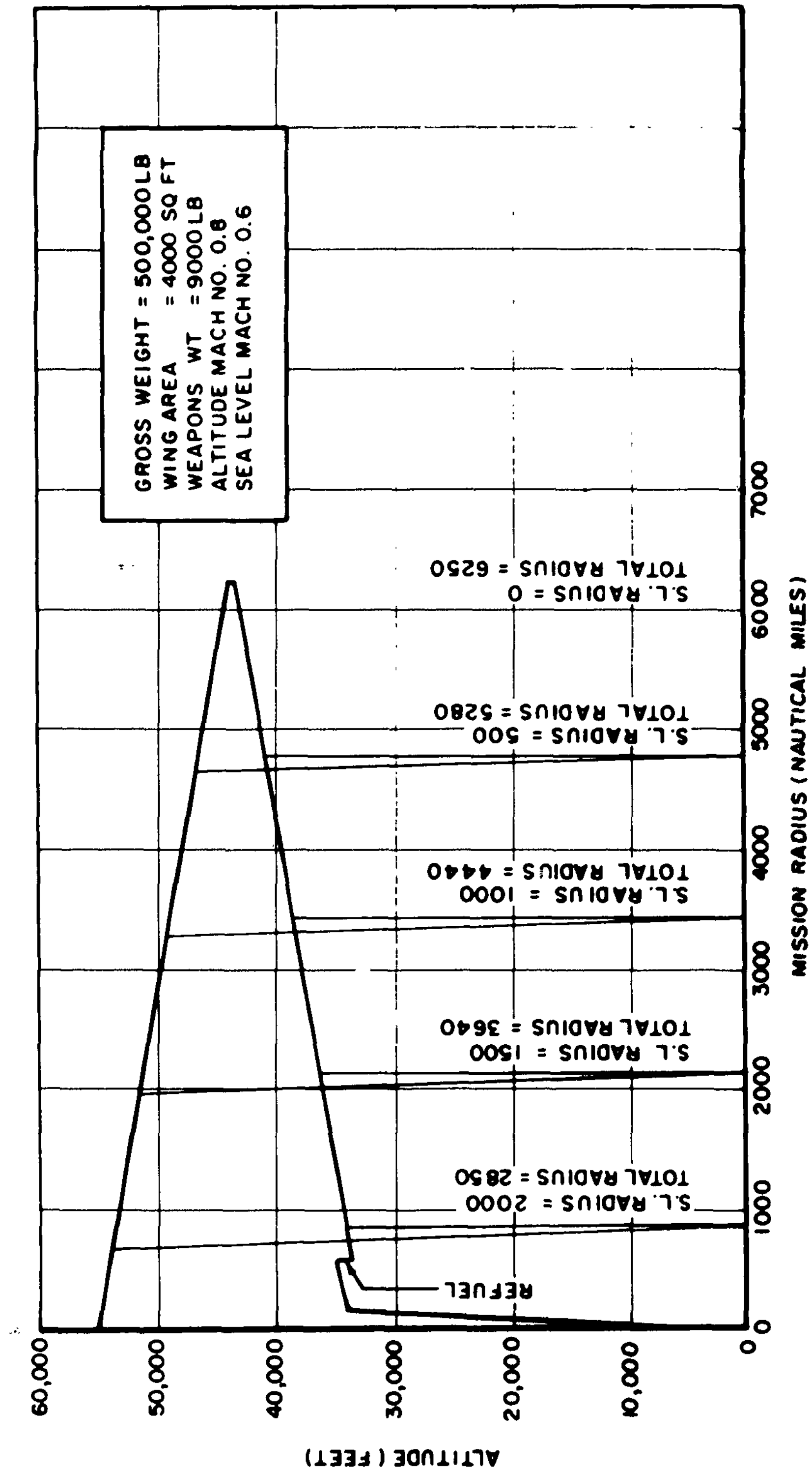

Figure 3. Subsonic Low Altitude Bomber; Strike Mission Profile with Refuel, Dash, and Launch

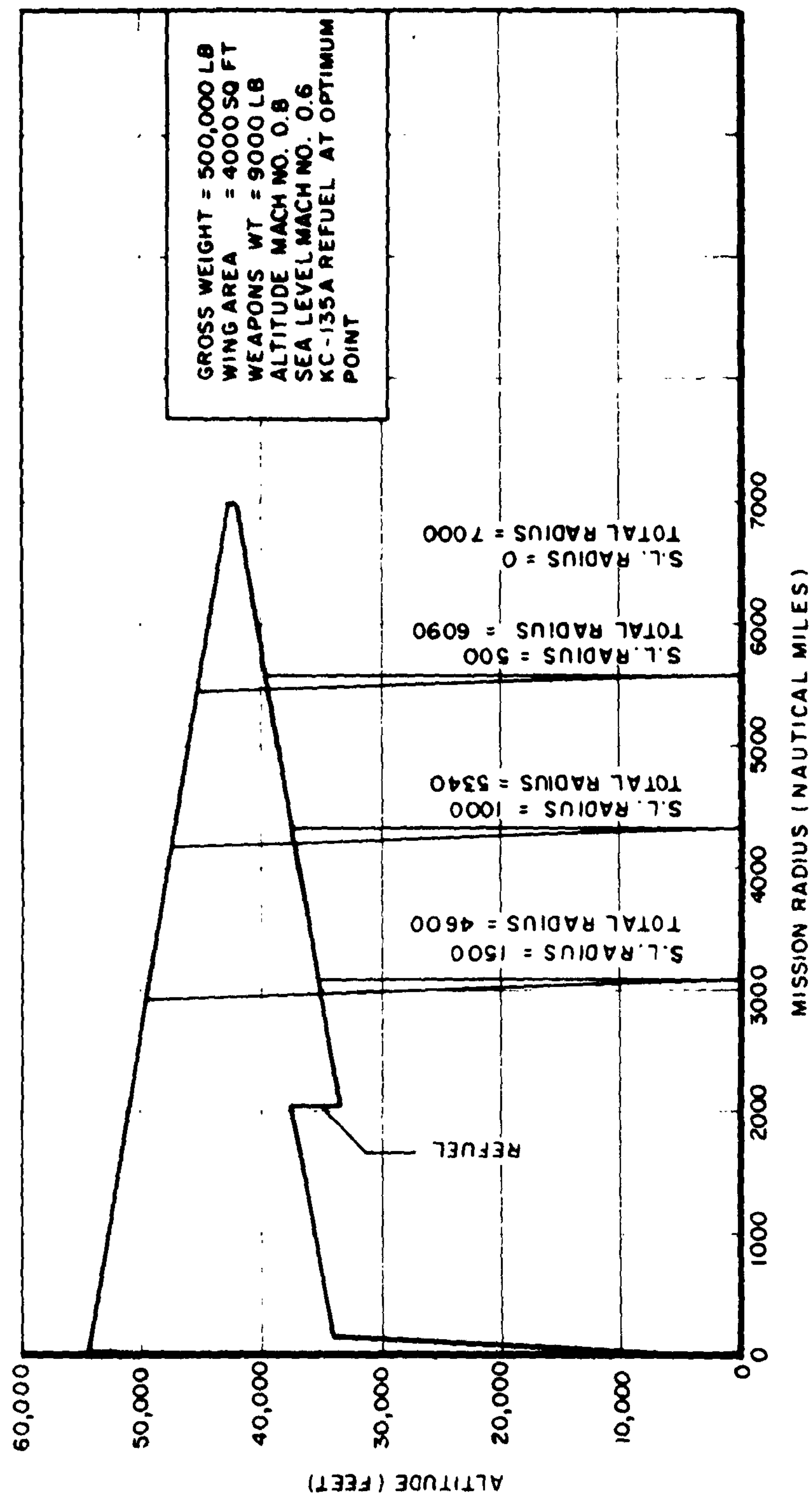

Figure 4. Subsonic Low Altitude Bomber, Maximum Strike Mission Profile with Refuel, Dash, and Launch

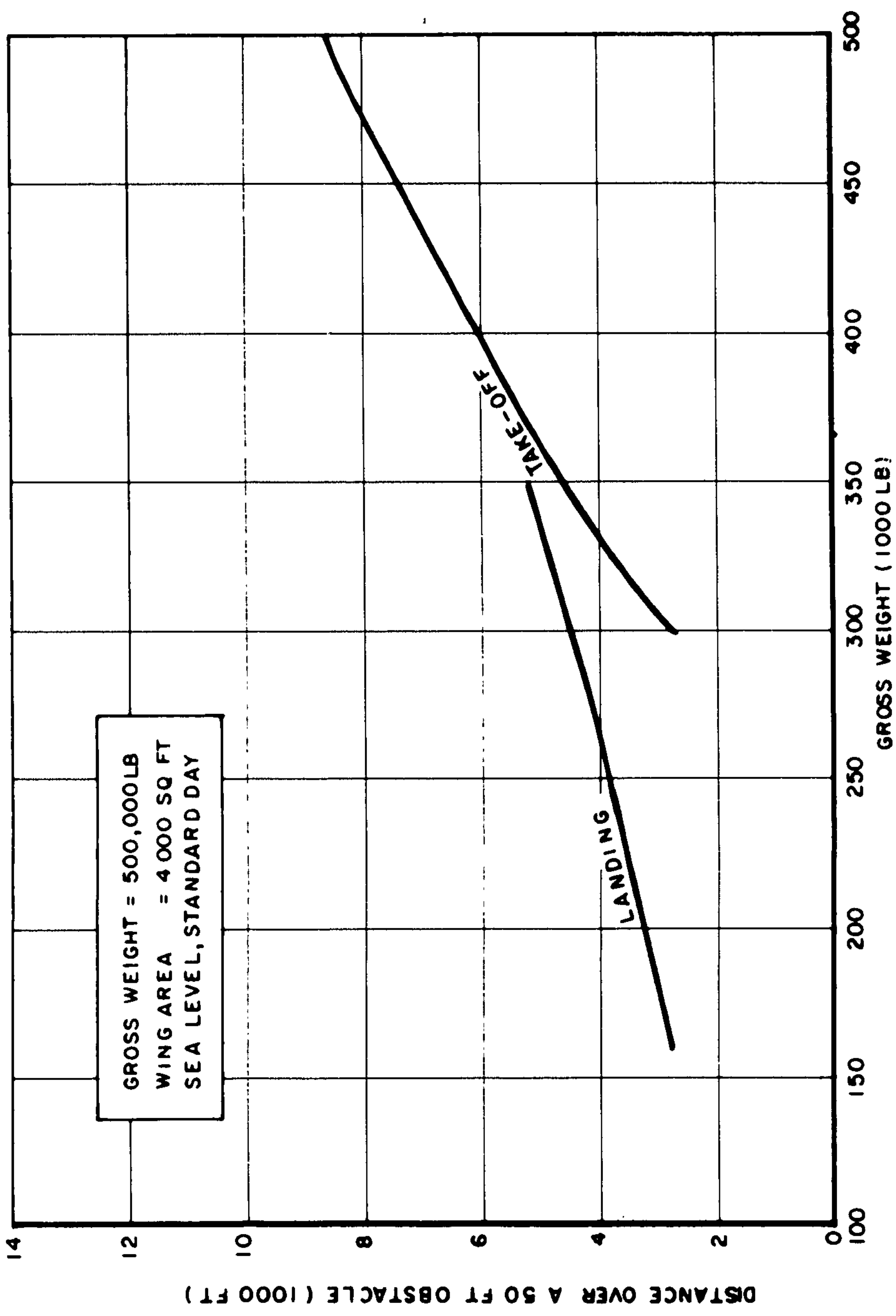

Figure 5. Subsonic Low Altitude Bomber; Take-Off and Landing Distance Over a 50-Foot Obstacle

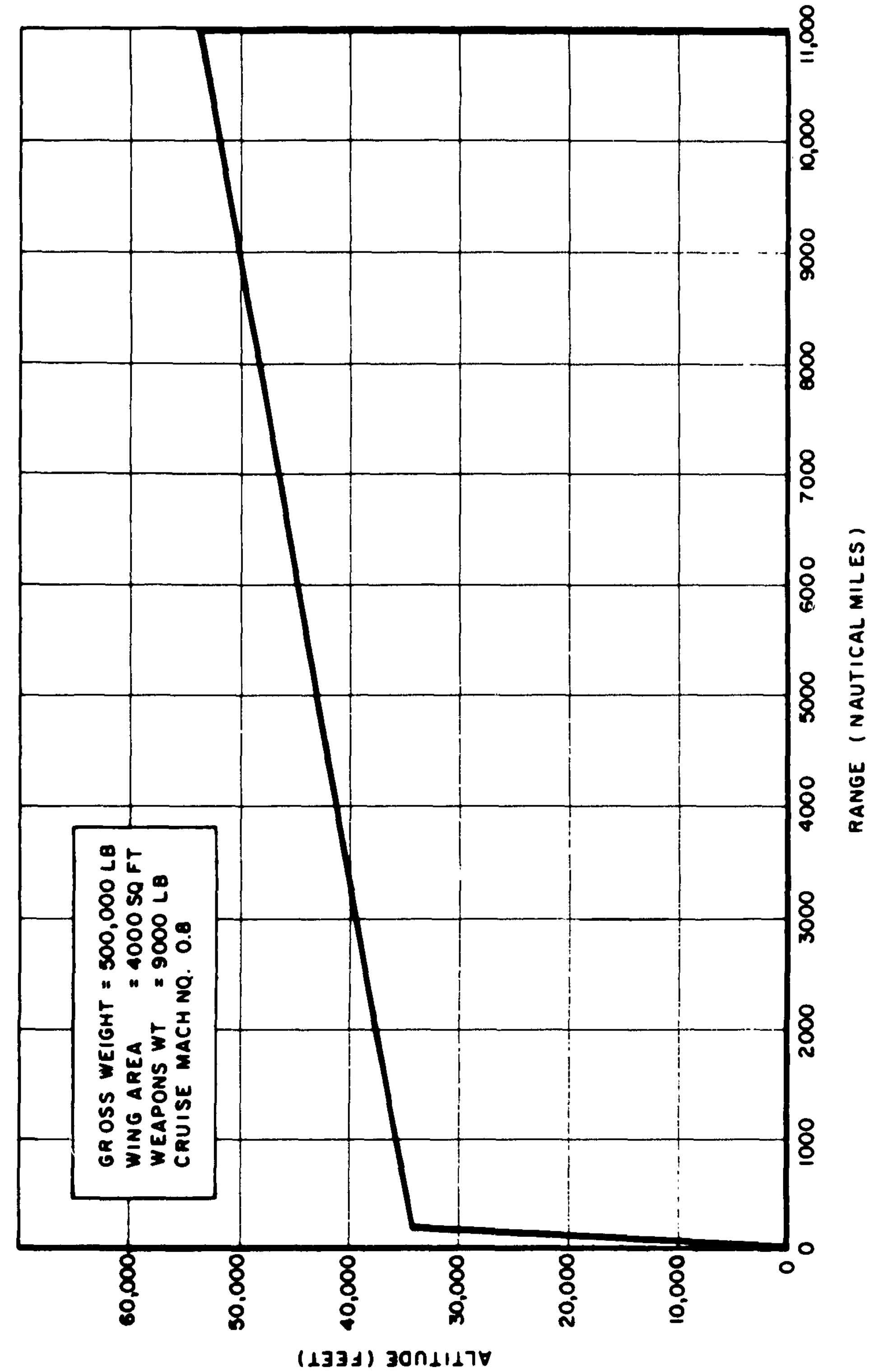

Figure 6. Subsonic Low-Altitude Bomber; Basic Mission Profile

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Secret report

A subsonic bomber has been studied for long range cruise with a capability for sea level dash during a sizable portion of the flight. Preliminary design and performance data are presented.

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Please call me at (937) 522-3091 if you have any questions.

Sincerely

Lynn Kane

Lynn Kane
Freedom of Information Act Analyst
Management Services Branch
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